

# Memristive devices for neural systems

## Neuromorphic engineering with memristive devices

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**DFG**

# Neuromorphic Systems

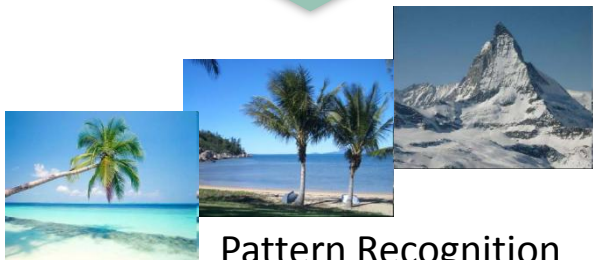
„non-biological systems functioning similarly to brains“ (Carver Mead, 1986)

**Learning:** Capability to process new information: Creation of knowledge

**Memory:** Capability to capture knowledge

## Computer vs. Brain

Arithmetics:  $\sqrt{2493241} = 1579$



Pattern Recognition  
(Associative Memory)

## Energy Efficiency

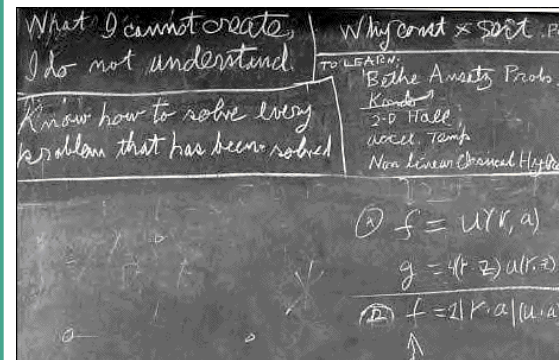
216kW      25W



IBM Watson  
IBM J. RES. & DEV. VOL. 56 2012

## Understanding

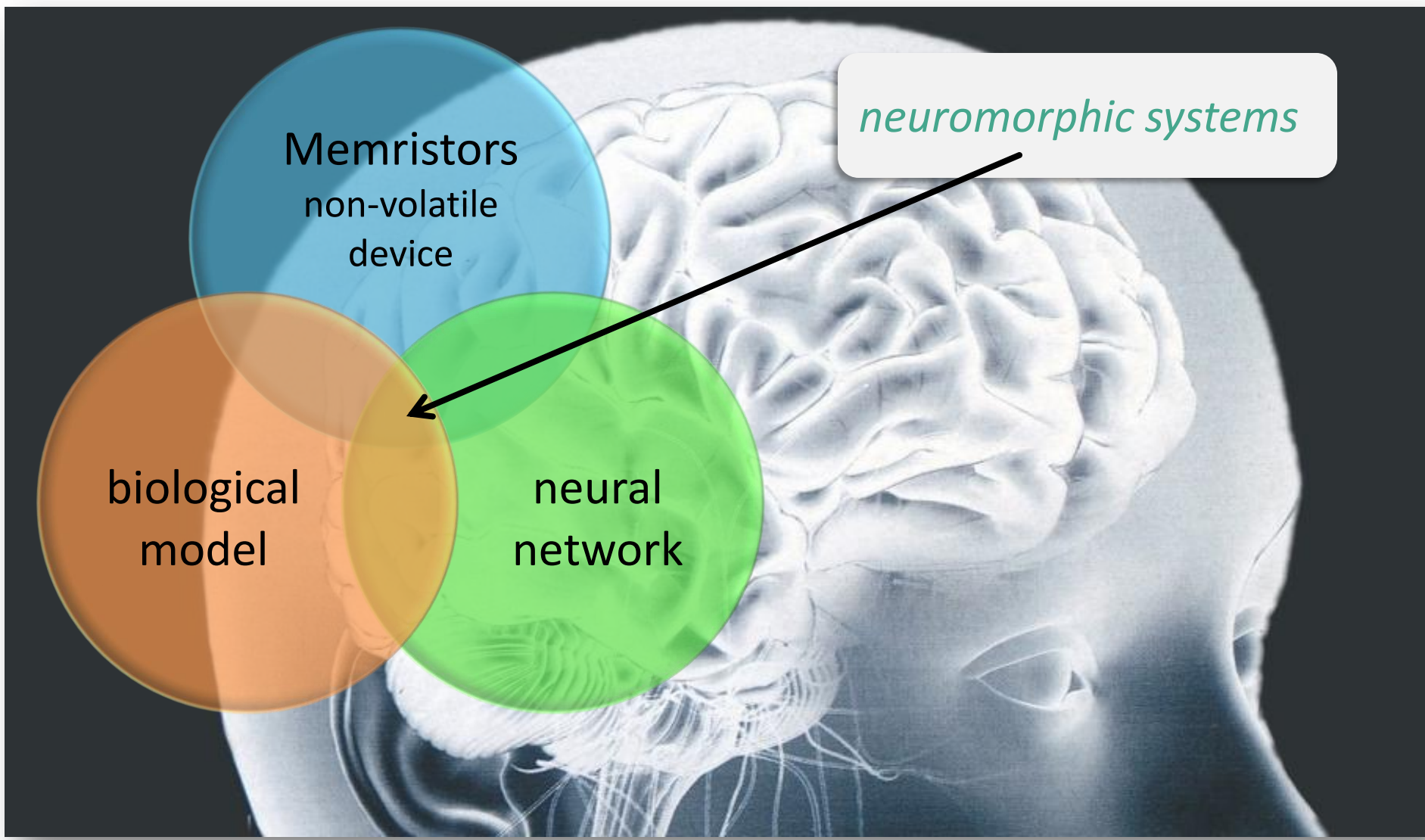
Richard Feynman's last bord



Richard Feynman (\* 1918 - † 1988)



# Building neuromorphic circuits



Memristors  
non-volatile  
device

*neuromorphic systems*

biological  
model

neural  
network